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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/765,532	01/27/2004	Daniel Aiken	1613370-0050	1028

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PATENT DEPARTMENT
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EXAMINER	
HALL, ASHA J	

ART UNIT	PAPER NUMBER
1709	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/765,532	AIKEN, DANIEL	
	Examiner	Art Unit	
	Asha Hall	1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/27/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-6, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Sharps et al. (" Wafer Bonding for Use in Mechanically Stacked Multi-Bandgap Cells", Proceedings of 26th IEEE Conference of Photovoltaic Specialists, September 1997, p-895-898).

In regard to claim 1, Sharps et al. disclose a multi-junction solar cell, comprising (Figure 1):

(a) plurality of monolithic cells, each monolithic cell including at least one junction/four junction cells (p.895; col. 1: Paragraph 2),

(b) each of the monolithic cells being bonded to at least one other of the monolithic cells with wafer bonding (p.895; col. 1: Paragraph 1) ,

(c) the direct wafer bond/thermal compression bonding does not include any intervening material between the monolithic cells (p.896; col. 2: Paragraph 2)

With respect to claim 2, Sharps et al. disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose the direct wafer bond in achieved by bonding forces between dipoles/n^+ on p^+ polarity at a surface of a

first one of the monolithic cells (Figure 1) and a surface of a second one of the monolithic cells (p.895; col. 2: Paragraph 1).

In regard to claim 3, Sharps et al disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose each of the plurality of monolithic cells has a band gap that is different from the band gaps of the other monolithic cells (p.895; col. 1: Paragraph 2).

With respect to claim 4, Sharps et al disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose the multi-junction solar cell that has been annealed/heated to a given temperature for a given time to strengthen the direct wafer bonds between the plurality of monolithic cells (p.896; col. 2: Paragraph 2).

In regard to claim 5, Sharps et al disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose the multi-junction solar cell as including four junctions (p.895; col. 1: Paragraph 2).

With respect to claim 6, Sharps et al disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose at least one of the plurality of monolithic cells includes more than one junction (p.895; col. 1: Paragraph 2).

In regard to claim 8, Sharps et al disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, and further disclose each of the plurality of monolithic cells that have a lattice constant different from the lattice constants of the other monolithic cells (p.895; col. 1: Paragraph 2).

3. Claims 9-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Zahler et al. ("Wafer Bonding and Layer Transfer Processes for 4-Junction High Efficiency Solar Cells", Proceedings of 29th IEEE Conference of Photovoltaic Specialists, 19-24 May 2002, p.1039-1042).

With respect to claim 9, Zahler et al. disclose a multi-junction solar cell comprising of a plurality of constituent cells (Figure 1), with each constituent cell including at least one junction, and further disclose that the plurality of constituent cells are being joined by wafer bonding (p.1039; col.2: paragraph 1).

In regard to claim 10, Zahler et al. disclose all of the elements of the multi-junction solar cell as discussed in claim 9 above, and further disclose the constituent cells as joined to at least one other of the constituent cells by wafer bonding, and the wafer bonding includes no intervening material between the joined constituent cells (p.1040; col.2: paragraph 3).

With respect to claim 11, Zahler et al. disclose all of the elements of the multi-junction solar cell as discussed in claim 9 above, and further disclose the plurality of constituent cells as a monolithic cell epitaxially grown on a separate substrate (p.1039; col.2: paragraph 2).

In regard to claim 12, Zahler et al. disclose all of the elements of the multi-junction solar cell as discussed in claim 9 above, and further disclose the wafer bonding as being achieved by bonding forces between surfaces of adjoining constituent cells (p.1040; col.2: paragraph 3).

With respect to claim 13, Zahler et al. disclose all of the elements of the multi-

junction solar cell as discussed in claim 9 above, wherein at least one of the plurality of constituent cells includes more than one junction (p.1039; col.1: paragraph 1).

In regard to claim 14, Zahler et al. disclose the method for producing a multi-junction solar cell, comprising of providing a plurality of monolithic cells, each monolithic cell having at least one junction/four junction (Figure 1); and joining together the plurality of monolithic cells with wafer bonding (p.1039; col.1: paragraph 1).

With respect to claim 15, Zahler et al. disclose the method of claim 14 above, and further disclose smoothing/applying a photoresist to protect the bonding surfaces from scratches and particles, once the samples are cleaved the photoresist is removed and the samples are ultrasonic cleaned with acetone and methanol followed by DI water, then rinsed to leave a smooth particle free surface prior to joining (p.1040; col.2: paragraph 3).

With respect to claim 16, Zahler et al. disclose the method of claim 14 above, and further disclose that the wafer bonding does not include any intervening material between surfaces of adjacent monolithic cells (p.1040; col. 2: paragraph 3).

With respect to claim 17, Zahler et al. disclose the method of claim 14 above, and further disclose that the direct wafer bonding is achieved by bonding forces between dipoles/polarity of n^+ (In P) at a surface of one of the monolithic cells and p^+ (Ge) a surface of another of the monolithic cells (Figure 1) (p.1040; col.1: paragraph 1).

With respect to claim 18, Zahler et al. disclose the method of claim 14 above, and further disclose that at least one of the plurality of monolithic cells includes more than one junction/four junctions (Figure 1) (p.1040; col.2: paragraph 1).

With respect to claim 19, Zahler et al. disclose the method of claim 14 above, and further disclose that annealing the multi-junction solar cell is done to strengthen the direct wafer bonds (p.1039; col.2: paragraph 2).

With respect to claim 20, Zahler et al. disclose the method of claim 14 above, and further disclose that the plurality of monolithic cells has a band gap that is different from the bandgaps of the other monolithic cells (Table 1) (p.1040; col.1: paragraph 1).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sharps et al. (" Wafer Bonding for Use in Mechanically Stacked Multi-Bandgap Cells", Proceedings of 26th IEEE Conference of Photovoltaic Specialists, September 1997, p-895-898) in view of Zahler et al. (" Wafer Bonding and Layer Transfer Processes for 4-Junction High Efficiency Solar Cells", Proceedings of 29th IEEE Conference of Photovoltaic Specialists, 19-24 May 2002, p-1039-1042).

In regard to claim 7, Sharps et al. disclose all of the elements of the multi-junction solar cell as discussed in claim 1 above, but fails to disclose each of the monolithic cells as being grown epitaxially on separate substrates.

Zahler et al. disclose a multi-junction solar cell (Figure 1), and further disclose that the monolithic cells are grown epitaxially on substrates separately, and then they are assembled (p. 1039; col. 2: paragraph 2). Zahler et al. further teaches that the single component epitaxial growth technique allows for lower loss power extraction from the back surface of the Si substrates (p. 1039; col. 2: paragraph 2). It would have been obvious to one of ordinary skill in the art at the time of invention to bond each epitaxially grown monolithic cells from separate substrates as taught by Zahler et al. to the mult-junction monolithic cells of Sharps et al., in order to achieve lower loss power extraction from the back surface of the Si substrates.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asha Hall whose telephone number is 571-272-9812. The examiner can normally be reached on Monday-Thursday 8:00-6:30 a.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AJH

ALEXA D. NECKEL
SUPERVISORY PATENT EXAMINER